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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/622,690

07/21/2003

Jui-Hua Fang

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4410

2292

7590

08/12/2004

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EXAMINER

LEE, CALVIN

ART UNIT

PAPER NUMBER

2825

DATE MAILED: 08/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/622,690

Applicant(s)

FANG ET AL.

Examiner

Lee Calvin

Art Unit

2825

AC

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 6/16/04.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 8, 10-14 and 18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 8, 10-14 and 18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 6/15/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

OFFICE ACTION

Response to Amendment

1. The cancellation of claims 6-7, 9, 15-17, and 19-20 dated June 16, 2004 is acknowledged.

Claim Rejections - 35 U.S.C. § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-3, 5, and 10-11 are rejected under 35 U.S.C. 102(e) as being anticipated by *Chen et al* (US 6,468,908).

Chen et al discloses a method of modifying a conductive wiring, comprising the steps of:

- forming a first barrier TiN **14** over a semiconductor substrate **10** [Fig. 1a]
- forming a wiring **16** of Al/Cu on the first barrier [Fig. 1b]
- forming a second barrier TiN **18** on the conductive wiring [Fig. 1c] after performing a thermal treatment on the substrate [Fig. 2], wherein the thermal treatment comprises “cooling the substrate from a high temperature range of 450 to 150°C, to a low temperature range near room temperature, in a short time interval of between 30 to 180 seconds” [col. 4]

4. Claims 1-5, 8, and 10-11 are rejected under 35 U.S.C. 102(e) as being anticipated by *Saito et al* (US 2001/0045651).

Saito et al discloses a method of modifying a conductive wiring, comprising the steps of forming a wiring **26b** sandwiched between first and second barrier **26a** and **26c** of TiN/Ti [Fig. 15a and paragraph 0134], or a wiring **35b** sandwiched between first and second barrier **35a** and **35c** of TiN/Ti [Fig. 19 and paragraph 0146]. *Saito et al* also discloses “after completion of CMP of copper

films **26b** and **35b**, the substrate surfaces are treated with hydrogen or annealed under conditions, for example, of 430°C and 10 Torr” [paragraph 0177].

Admittedly both *Saito et al* and *Chen et al* are silent about the first barrier on the substrate. However, Applicants recognize in page 4 “the semiconductor substrate 100 can comprise and have desired elements ... are not shown in order to simply the explanation.” Therefore, *Chen et al*, as well as *Saito et al*, does read on the claimed feature “a first barrier on a semiconductor substrate.”

Claim Rejections - 35 U.S.C. § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made

6. Claims 4, 8, 12-14, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Chen et al*, as applied to claim 1, in view of *Lee et al* (US 5,843,843).

a) In re claim 4, *Chen et al* discloses heat treatment by quenching but not by baking. Nevertheless, such thermal treatment by baking is known in the semiconductor processing art as evidenced by *Lee et al* disclosing to form a second barrier (not shown) on a conductive wiring **27** after heat treating the wiring using an argon condition method [col. 16].

It would have been obvious to one of ordinary skill to have modified the heat treatment of *Chen et al* by utilizing baking treatment of a conductive wiring for the purpose of improving the step coverage and the filling of a conductive wiring.

b) In re claims 8, 12-14, and 18, *Lee et al* suggests the thermal treatment being performed in argon but not in nitrogen atmosphere. However, *Lee et al* teaches “annealing the TiN layer under a N₂ atmosphere” [col. 12].

It would have been obvious to one of ordinary skill to have modified the thermal treatment of *Chen et al* by utilizing a thermal treatment, which is performed in an atmosphere containing nitrogen, for the purpose of “enhancing the step coverage of the metal layer” [col. 12, ln.45].

7. Claims 8, 12-14, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Saito et al*, as applied to claim 1.

Saito et al discloses a hydrogen (anneal) treatment but not in nitrogen atmosphere. However, *Saito et al* teaches “an ammonia plasma treatment is effected at 360°C after the formation of layers 26c and 35c” [paragraph 0182].

It would have been obvious to one of ordinary skill to have modified the thermal treatment of *Saito et al* by utilizing a thermal treatment, which is performed in an atmosphere containing nitrogen, for the purpose of “improving reliability of the Cu wiring.”

Response to Arguments

8. Applicant’s arguments in the remark, dated June 16, 2004, with respect to the rejection of claims 1, 3-8, 10-12, 14, and 16-18 under 35 USC 102(b) as being anticipated by *Ng* have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground of rejection is made in view of *Chen et al* and/or *Saito et al*.

Contact Information

9. Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at (571) 272-1896 from 7:00 to 17:00 (Monday-Thursday). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *Matthew Smith* can be reached at (571) 272-1907.

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The central fax number is (703) 872-9306 for all communications to be entered (e.g., amendments, remarks, IDS, etc.)

CL

C. Everhart
CARIDAD EVERHART
PRIMARY EXAMINER

August 11, 2004